USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002KY6B

Title: Impacts of surface mine valley fills on downstream peak flows in eastern Kentucky

Project Type: Research

Focus Categories: Floods, Surface Water, Hydrology

Keywords: channel response, mountain-top removal, fluvial geomorpholgy

Start Date: 03/01/2002

End Date: 02/28/2003

Federal Funds Requested: $7,965

Non-Federal Matching Funds Requested: $21,198

Congressional District: Sixth

Principal Investigator:
Jonathan Phillips
University of Kentucky

Abstract

Surface mining in general, and mountaintop removal/valley fill coal mining in the southern Appalachians in particular, raises numerous questions about hydrologic impacts. The issue of the effect of valley fills on peak flows has recently emerged as a critical controversy. Disastrous flash floods occurred in the coalfields of eastern Kentucky, southern West Virginia, and southwestern Virginia in 2001. Press reports, anecdotes, and activist claims suggested that flooding and mudslides were both more common and more severe in basins influenced by valley fills and mountaintop removal mining than in nearby unmined basins. The coal industry and its supporters generally characterized the flooding as "acts of God," suggesting that the intense precipitation in the basins experiencing flooding would have occurred with or without valley fills. The hydrology literature is equivocal, and principles of physical hydrology suggest mechanisms by which valley fills and associated surface mining might tend to increase or decrease downstream floods. There are thus both public and scientific controversies surrounding the potential impacts of mountain top removal/valley fill mining on flash floods, mud slides, and peak flows. The purpose of this study is to determine whether channel capacities reflect increases in the magnitude or frequency of high flows downstream of mountaintop removal valley fills in eastern Kentucky.

The proposed project is based on the fundamental principle that channel dimensions reflect the flows they carry. Because bankfull channel dimensions typically reflect flows with a mean recurrence interval of a year or greater, changes in peak flow regimes may be expected to result in changes in channel capacities. If mountaintop removal/valley fill mining produces greater amounts of runoff during high flow events, this should be reflected in larger channels for any given drainage area. While this method uses a surrogate of flow rather than measuring flow itself, it does allow examination of a number of basins and channels, and is a direct examination of field evidence of hydrologic change. The objectives are to characterize relationships between drainage area and channel capacity in eastern Kentucky drainage basins impacted by mountaintop removal mining and stream valley fills, and basins not affected by mining, using channel capacity/drainage area ratios, and regression relationships. By comparing and contrasting relationships between valley fill and unmined areas, it can be determined whether valley fills have increased the magnitude of high flows

downstream. The channel morphometry based approach will allow numerous sites to be examined, thus avoiding the issues of small sample size and limited spatial and temporal coverage associated with paired-watershed studies. This method will also provide opportunities to assess the influence of other variables, such as the size and extent of surface mining and valley fill, the age and reclamation of fills, and local variations in geology, vegetation, microclimate, soils, and land use.